

The Marine Decapod Crustaceans of Geojedo Island and Its Adjacent Islets, Korea

Sa Heung Kim and Won Kim

(Department of Molecular Biology, Seoul National University, Seoul 151-742, Korea)

ABSTRACT

A taxonomic study for clarifying the decapod fauna of Geojedo Island, Korea was performed. Seventy nine species in 28 families were identified through the present investigation and of which 9 species of shrimps, 7 species of anomurans, and 39 species of crabs are newly added to the decapod fauna of this area. With the previously known 40 species, a total of 93 decapod species from this island and its adjacent islets are listed, and *Pugettia quadridens intermedia* Sakai, 1939 is redescribed with illustrations. The zoogeographical aspects of Geojedo Island are also discussed based on the composition of geographical forms of brachyuran decapods.

Key words: Crustacea, Decapoda, distribution forms, Geojedo Island, Korea

INTRODUCTION

Although Geojedo Island is the second largest island in Korea, the faunistic and taxonomic studies on the decapods of this island has been insufficiently investigated. The marine fauna of Geojedo Island is very important from the viewpoint of the zoogeographical consideration of Korea because this area has been considered to be strongly influenced by the Tsushima warm current as in the case of Chejudo (Kim and Kim, 1982). Kamita (1941) first reported 13 species of crabs from Geojedo Island. After that, Kim *et al.*' (1979) report was the only other report from this area in which 28 species are listed. Through these two reports, a total of 40 decapod species were reported from Geojedo Island and its islets prior to the present study. They are 3 species of the shrimps, 10 species of anomurans, and 27 species of crabs.

Under these circumstances, a scientific survey was carried out in order to reveal the decapod fauna of Geojedo Island and its adjacent islets. The present study was based on the materials collected from

7 localities (Fig. 1) in Geojedo Island during the period from July 1996 to September 1998. Specimens were chiefly collected from the subtidal zone by scuba diving and from the muddy and rocky shore by various instruments. Additionally, collectings were also done from fishing traps and nets. Specimens were fixed with 95% ethylalcohol immediately. As a result of examining the present materials, 79 species were identified. Of these, 55 species are new to the decapod fauna of Geojedo Island and its adjacent islets. In this paper, a total of 93 species are listed with some informations, if any, and one Majid crab, *Pugettia quadridens intermedia* Sakai, 1938, a species poorly known in Korea, is redescribed with illustrations.

For the morphological study, a stereomicroscope and a light microscope were used. The drawing and the measuring were made with the aid of a camera lucida. Classification scheme above the family level is after Bowman and Abele (1982). All specimens examined are deposited in the collections of the senior author.

SYSTEMATIC LIST

The following systematic list about the decapod fauna of the Geojedo Island and its adjacent islets consist of all the species appeared in the previous literatures and newly examined in the present study. In the list, a single asterisk (*) indicates the species collected from the present survey and the double asterisks (**) indicate the species newly reported from Geojedo Island and its adjacent islets by the present study. The "Material examined" section lists all specimens examined and the "Literature(s)" section in each species lists the reference(s) containing the species previously reported from these area.

Order Decapoda Latreille, 1803 십각 목

Suborder Dendrobranchiata Bate, 1888 근새 아목

Family Penaeidae Rafinesque, 1815 보리새우 과

****1. *Metapenaeus joyneri* (Miers, 1880) 중하**

Material examined. 3♂♂, 1♀, Geojedo I. (Okpo fish market), 29 Jan. 1997.

****2. *Penaeus japonicus* Bate, 1888 보리새우**

Material examined. 3♂♂, 1♀, Geojedo I. (Okpo fish market), 29 Jan. 1997.

Family Rhynchocinetidae Ortmann, 1890 꼬덕새우 과

****3. *Rhynchocinetes uritai* Kubo, 1942 꼬덕새우**

Material examined. 2♂♂, 1♀, Ssanggeun, 8 Jul. 1996; 5♂♂, 2♀♀, Oepo, 9 Jul. 1996; 1♂, Yeocha, 9 Jul. 1996; 2♀, Heungnam, 30 Jan. 1997.

Family Palaemonidae Rafinesque, 1815 징거리미새우 과

****4. *Palaemon macrodactylus* Rathbun, 1902 붉은줄참새우**

Material examined. 4♂♂, 5♀♀, Ssanggeun, 8 Jul. 1996; 2♂♂, 7♀♀, Tabpo, 13 Sep. 1998.

Family Alpheidae Rafinesque, 1815 딱총새우 과

****5. *Alpheus bisincisus* De Haan, 1849** 흠발딱총새우

Material examined. 3♂♂, 2♀♀, Tabpo, 13 Sep. 1998.

****6. *Alpheus brevicristatus* De Haan, 1844** 딱총새우

Material examined. 3♂♂, 2♀♀, Tabpo, 13 Sep. 1998.

***7. *Synalpheus tumidomanus* (Paulson, 1875)** 세이마뿔딱총새우

Material examined. 1♂, 1♀, Ssanggeun, 8 Jul. 1996; 3♂♂, Heungnam, 30 Jan. 1997.

Literature. Kim *et al.*, 1979 (1♀, Hongdo).

Remarks. This species is widely distributed in the Indo-West Pacific region. In Korea, this shrimp was first reported by Kim *et al.* (1979) from Hongdo, southern part of Geojedo Island without redescription and figure. Thereafter Kim and Moon (1994) reported two individuals from Ullungdo Island with the redescription and illustrations. The present specimens were collected mainly among bryozoans and sea weeds.

Family Hippolytidae Dana, 1852 꼬마새우 과

***8. *Heptacarpus rectirostris* (Stimpson, 1860)** 좁은뿔꼬마새우

Material examined. 7♂♂, 13♀♀, Ssanggeun, 8 Jul. 1996; 2♂♂, 4♀♀, Yeocha, 9 Jul. 1996.

Literature. Kim *et al.*, 1979 (1♂, 1♀, Yeonhwado; 3♀♀, Haegeumgang).

Family Hippolytidae Dana, 1852 꼬마새우 과

9. *Crangon hakodatei* Rathbun, 1902 마루자주새우

Literature. Kim *et al.*, 1979 (18 inds, Gugdo).

Infraorder Astacidea Latreille, 1803 가재 하목

Family Nephropsidae Dana, 1852 가시발새우 과

****10. *Metanephrops thomsoni* (Bate, 1888)** 가시발새우

Material examined. 3♂♂, 1♀, Geojedo I. (Okpo fish market), 29 Jan. 1997.

Infraorder Palinura Latreille, 1803 닭새우 하목

Family Scyllaridae Latreille, 1825 매미새우 과

****11. *Ibacus ciliatus* (Von Siebold, 1824)** 부채새우

Material examined. 3♂♂, 1♀, Geojedo I. (Okpo fish market), 29 Jan. 1997.

****12. *Scyllarus kitanoviriosus* Harada, 1962** 꼬마매미새우

Material examined. 3♂♂, 1♀, Geojedo I. (Okpo fish market), 29 Jan. 1997.

Infraorder Thalassinidea Latreille, 1831 쪽 하목

Family Laomediidae Borradaile, 1903 가재붙이 과

****13. *Laomedea astacina* De Haan, 1849** 가재붙이

Material examined. 3♂♂, 2♀♀, Tabpo, 13 Sep. 1998.

Family Upogebiidae Borradaile, 1903 쪽 과

****14. *Upogebia major* (De Haan, 1849) 쪽**

Material examined. 3♂♂, 2♀♀, Tabpo, 13 Sep. 1998.

Remarks. In Korea, an alpheid shrimp, *Chelomalpheus koreanus* Kim, 1998 is found only from the burrows of this species with some Athanas species. However, they were not found in the present study. *Upogebia major* and these crustacean associates are widely distributed in the mud flat of the southern and western coasts of Korea.

Infraorder Anomura H. Milne Edwards, 1832 집게 하목

Family Diogenidae Ortmann, 1892 넓적원손집게 과

***15. *Dardanus arrosor* (Herbst, 1796) 털줄원손집게**

Material examined. 3♂♂, 1♀, Daepo, 9 Jul. 1996; 2♂♂, Daepo, 14 Sep. 1998.

Literature. Kim *et al.*, 1979 (18 inds, Gugdo).

***16. *Diogenes edwardsii* (De Haan, 1849) 넓적원손집게**

Material examined. 3♂♂, Susan, 29 Jan. 1997; 1♂, 1♀, Daepo, 14 Sep. 1998.

Literature. Kim *et al.*, 1979 (18 inds, Gugdo).

***17. *Paguristes ortmanni* Miyake, 1978 털보간손집게**

Material examined. 2♂♂, 2♀♀, Oepo, 7 Jul. 1996; 3♂♂, Yeocha, 9 Jul. 1996; 1♂, Susan, 29 Jan. 1997; 1♂, 2♀♀, Heungnam, 30 Jan. 1997; 7♂♂, 6♀♀, Daepo, 14 Sep. 1998.

Literature. Kim *et al.*, 1979 (1 ind., Bijindo; 1 ind., Galdo; 2 inds., Haegeumgang)

Family Lithodidae Samouelle, 1819 왕게 과

***18. *Oedignathus inermis* (Stimpson, 1860) 두드러기어리게**

Material examined. 1♂, Heungnam, 30 Jan. 1997.

Literature. Kim *et al.*, 1979 (5♂♂, 1♀, Bijindo; 3♂♂, 1♀, Yeonhwado; 2♂♂, 1♀, Hongdo; 1♀, Galdo)

Remarks. This species, considered as northern form, is widely distributed in the Korean waters. This species is the only northern form found in this study.

Family Paguridae Latreille, 1803 집게 과

****19. *Pagurus brachiomastus* (Thallwitz, 1892) 털손참집게**

Material examined. 5♂♂, 8♀♀, Oepo, 7 Jul. 1996; 2♀♀, Heungnam, 30 Jan. 1997.

***20. *Pagurus lanuginosus* De Haan, 1849 털다리참집게**

Material examined. 5♂♂, 2♀♀, Oepo, 7 Jul. 1996; 1♂, Yeocha, 9 Jul. 1996; 2♂♂, 1♀, Susan, 29 Jan. 1997; 3♂♂, 4♀♀, Daepo, 14 Sep. 1998.

Literature. Kim *et al.*, 1979 (8 inds., Galdo; 1 ind., Haegeumgang).

****21. *Pagurus dubius* (Ortmann, 1892) 긴발가락참집게**

Material examined. 12♂♂, 8♀♀, Tabpo, 13 Sep. 1998.

***22. *Pagurus japonicus* Stimpson, 1858 붉은눈자루참집게**

Material examined. 1♂, Daepo, Jul. 9, 1996; 3♂♂, 1♀, Daepo, 14 Sep. 1998.

Literature. Kim *et al.*, 1979 (1 ind., Galdo).

23. *Pagurus similis* (Ortmann, 1892) 얼룩참집게*Material examined.** 1 ♂, 2 ♀, Daepo, 9 Jul. 1996; 2 ♂, Daepo, 14 Sep. 1998.**Literature.** Kim *et al.*, 1979 (1 ind., Galdos).****24. *Pagurus pectinatus* (Stimpson, 1858) 빗참집게****Material examined.** 1 ♂, Daepo, 9 Jul. 1996; 3 ♂, 1 ♀, Daepo, 14 Sep. 1998.****25. *Pagurus constans* (Stimpson, 1858) 제집참집게****Material examined.** 1 ♂, Daepo, 9 Jul. 1996; 3 ♂, 1 ♀, Daepo, 14 Sep. 1998.

Family Galatheididae Samouelle, 1819 새우붙이 과

26. *Galathea orientalis* Stimpson, 1858 새우붙이*Material examined.** 1 ♂, Yeocha, 9 Jul. 1996; 3 ♂, 1 ♀, Heungnam, 30 Jan. 1997.**Literature.** Kim *et al.*, 1979 (2 ♂, Yeonhwado; 1 ♀, Hongdo; 4 ♀, Haegeumgang).

Family Porcellanidae Haworth, 1825 게붙이 과

27. *Pachycheles stevensii* Stimpson, 1858 게붙이*Material examined.** 9 ♂, 3 ♀, Oepo, 7 Jul. 1996; 6 ♂, 7 ♀, Yeocha, 9 Jul. 1996; 21 ♂, 17 ♀, Susan, 29 Jan. 1997; 18 ♂, 23 ♀, Heungnam, 30 Jan. 1997.**Literature.** Kim *et al.*, 1979 (3 ♂, 1 ♀, Hongdo; 9 ♂, 8 ♀, Haegeumgang).***28. *Pisidia serratifrons* (Stimpson, 1858) 알통게붙이****Material examined.** 5 ♂, 2 ♀, Ssanggeun, 8 Jul. 1996; 2 ♂, 2 ♀, Yeocha, 9 Jul. 1996; 8 ♂, 5 ♀, Susan, 29 Jan. 1997; 11 ♂, 4 ♀, Heungnam, 30 Jan. 1997.**Literature.** Kim *et al.*, 1979 (2 ♂, 2 ♀, Yeonhwado).****29. *Porcellana pulchra* Stimpson, 1858 매킨이게붙이****Material examined.** 3 ♂, 1 ♀, Oepo, 7 Jul. 1996; 1 ♂, 1 ♀, Yeocha, 9 Jul. 1996; 5 ♂, 4 ♀, Susan, 29 Jan. 1997; 12 ♂, 7 ♀, Heungnam, 30 Jan. 1997.

Infraorder Brachyura Latreille, 1803 게 하목

Family Dromiidae De Haan, 1833 해면치레 과

30. *Cryptodromia tumida* Stimpson, 1858 갯가해면치레**Literature.** Kim *et al.*, 1979 (1 ♀, Galdos).****31. *Dromia dehaani* Rathbun, 1923 해면치레****Material examined.** 1 ♂, Gabae, 9 Jul. 1996.****32. *Dromidia unidentata* (Rüppell, 1830) 털보해면치레****Material examined.** 1 ♂, Daepo, 14 Sep. 1998.**Remarks.** This rare species is distributed in Korea, Japan, the Indo-West Pacific, the Red Sea, and East Africa to New Guinea. In Korea, one ovigerous female of this species was reported from Chejudo by Kim and Rho (1971) as new to Korean waters. This report is the second in Korean waters.****33. *Petalomera japonica* (Henderson, 1888) 갯솜물히****Material examined.** 1 ♂, Heungnam, 30 Jan. 1997.****34. *Petalomera wilsoni* (Fulton and Grant, 1902) 솜털물히****Material examined.** 5 ♂, 6 ♀, Daepo, 9 Jul. 1996; 11 ♂, 6 ♀, Daepo, 14 Sep. 1998.

Family Dorippidae MacLeay, 1838 조개치레 과

****35. *Paradorippe granulata* (De Haan, 1839) 옴조개치레**

Material examined. 5♂♂, 6♀♀, Daepo, 9 Jul. 1996; 11♂♂, 6♀♀, Daepo, 14 Sep. 1998.

Family Leucosiidae Samouelle, 1819 밤게 과

****36. *Arcania undecimspinosa* De Haan, 1841 열한가시밤게**

Material examined. 3♂♂, 4♀♀, Daepo, 9 Jul. 1996; 2♂♂, Daepo, 14 Sep. 1998.

****37. *Philyra pisum* De Haan, 1841 밤게**

Material examined. 2♂♂, Tabpo, 13 Sep. 1998.

Literature. Kamita, 1941.

Remarks. This species is widely distributed in muddy littoral zone of southern and western coasts in Korea.

Family Cancridae Latreille, 1803 은행게 과

****38. *Cancer gibbosulus* (De Hann, 1833) 두드러기은행게**

Material examined. 1♂, Daepo, 9 Jul. 1996; 1♂, Daepo, 14 Sep. 1998.

****39. *Cancer amphioesus* Rathbun, 1898 꼬마은행게**

Material examined. 1♂, Oepo, 7 Jul. 1996.

Family Atelecyclidae Ortmann, 1893 털게 과

****40. *Telmessus acutidens* (Stimpson, 1858) 왕밤송이게**

Material examined. 1♂, Heungnam, 30 Jan. 1997.

Family Portunidae Rafinesque, 1815 꽃게 과

****41. *Ovalipes punctatus* (De Haan, 1883) 깨다시꽃게**

Material examined. 2♂♂, Daepo, 9 Jul. 1996; 1♂, 2♀♀, Daepo, 14 Sep. 1998.

****42. *Liocarcinus corrugatus* (Pennant, 1777) 주름꽃게**

Material examined. 8♂♂, 4♀♀, Daepo, 9 Jul. 1996; 11♂♂, 9♀♀, Daepo, 14 Sep. 1998.

****43. *Charybdis acuta* (A. Milne Edwards, 1869) 홍색민꽃게**

Material examined. 2♂♂, Daepo, 9 Jul. 1996; 1♂, 1♀, Daepo, 14 Sep. 1998.

****44. *Charybdis japonica* (A. Milne Edwards, 1861) 민꽃게**

Material examined. 5♂♂, 4♀♀, Daepo, 9 Jul. 1996; 7♂♂, 2♀♀, Daepo, 14 Sep. 1998.

****45. *Charybdis bimaculata* (Miers, 1886) 두점박이민꽃게**

Material examined. 1♂, Oepo, 7 Jul. 1996; 8♂♂, 4♀♀, Daepo, 9 Jul. 1996; 11♂♂, 9♀♀, Daepo, 14 Sep. 1998.

****46. *Portunus gladiator* Fabricius, 1798 두드러기꽃게**

Material examined. 1♂, Oepo, 7 Jul. 1996. 1♂, Daepo, 14 Sep. 1998.

****47. *Portunus trituberculatus* (Miers, 1876) 꽃게**

Material examined. 5♂♂, 4♀♀, Daepo, 9 Jul. 1996; 7♂♂, 2♀♀, Daepo, 14 Sep. 1998.

48. *Scylla serrata* (Forskål, 1755) 톱날꽃게

Literature. Kamita, 1941.

Remarks. This rare species is southern form distributed in Korea, Japan, and the Indo-West Pacific. In Korea, one male of this species was reported by Kamita (1941) as new to Korean waters from Geoje Island. Since then Kim *et al.* (1979) and Kim and Kim (1982) reported again this species based upon one male specimen collected from Pusan, respectively. Until now, these three are the only reports on this species in Korea.

****49. *Thalamita sima* H. Milne Edwards, 1834** 두갈래민꽃게

Material examined. 2♂♂, Heungnam, 30 Jan. 1997.

Family Goneplacidae MacLeay, 1838 원숭이게 과

****50. *Carcinoplax longimana* (De Haan, 1833)** 원숭이게

Material examined. 3♂♂, 1♀, Daepo, 9 Jul. 1996; 1♂, 2♀♀, Daepo, 14 Sep. 1998.

****51. *Carcinoplax vestita* (De Haan, 1833)** 털보원숭이게

Material examined. 5♂♂, 3♀♀, Daepo, 9 Jul. 1996; 1♂, 2♀♀, Daepo, 14 Sep. 1998.

****52. *Eucrate crenata* De Haan, 1835** 무딘이빨게

Material examined. 3♂♂, 4♀♀, Daepo, 9 Jul. 1996; 7♂♂, 3♀♀, Daepo, 14 Sep. 1998.

Family Xanthidae Macleay, 1838 부채게 과

***53. *Actaea semblatae* Guinot, 1976** 움부채게

Material examined. 1♂, Oepo, 7 Jul. 1996; 2♀♀, Ssanggeun, 8 Jul. 1996.

Literature. Kim *et al.*, 1979 (1♂, Yeonhwado; 2♂♂, 2♀♀, Hongdo).

***54. *Gaillardiiellus orientalis* (Odhner, 1925)** 털부채게

Material examined. 1♀, Yeocha, 9 Jul. 1996; 1♂, Heungnam, 30 Jan. 1997.

Literature. Kim *et al.*, 1979 (2♂♂, 1♀, Hongdo; 5♂♂, Galdo; 1♂, Haegeumgang).

55. *Leptodius exaratus* (H. Milne Edwards, 1834) 부채게

Literature. Kim *et al.*, 1979 (1♂, Yeonhwado).

56. *Macromedaeus distinguendus* (De Haan, 1835) 꽃부채게

Literature. Kim *et al.*, 1979 (4♂♂, 4♀♀, Hongdo).

57. *Neoliomera insularis* (White, 1847) 꼬마매끈이송편게

Literature. Kim *et al.*, 1979 (1♂, Hongdo).

58. *Heteropanope indica* (De Man, 1887) 네톱니부채게

Literature. Kim *et al.*, 1979 (1♂, 1♀, Hongdo).

***59. *Pilumnus minutus* De Haan, 1833** 애기털보부채게

Material examined. 16♂♂, 13♀♀, Oepo, 7 Jul. 1996; 7♂♂, 10♀♀, Ssanggeun, 8 Jul. 1996; 4♀♀, Daepo, 9 Jul. 1996; 5♂♂, 9♀♀, Yeocha, 9 Jul. 1996; 16♂♂, 13♀♀, Susan, 29 Jan. 1997; 13♂♂, 19♀♀, Heungnam, 30 Jan. 1997; 1♂, 2♀♀, Daepo, 14 Sep. 1998.

Literature. Kim *et al.*, 1979 (4♂♂, 7♀♀, Yeonhwado; 1♂, Hongdo; 3♀♀, Haegeumgang).

****60. *Sphaerozius nitidus* Stimpson, 1858** 비단부채게

Material examined. 1♂, Oepo, 7 Jul. 1996; 2♀♀, Ssanggeun, 8 Jul. 1996; 1♀, Yeocha, 9 Jul. 1996.

Family Ocypodidae Rafinesque, 1815 달랑게 과

61. *Scopimera globosa* De Haan, 1835 엽낭게

Literature. Kamita, 1941.

Remarks. This species is dominant in sandy littoral zone of southern and western coasts in Korea. Kamita (1941) reported this species from Geojedo Island. Thereafter, it has not been found from these areas until now.

****62. *Ilyoplax pusilla* (De Haan, 1835) 넓적콩게**

Material examined. 18♂♂, 14♀♀, Tabpo, 13 Sep. 1998.

****63. *Macrophthalmus dilatatus* (De Haan, 1835) 길게**

Material examined. 2♂♂, 1♀, Tabpo, 13 Sep. 1998.

***64. *Macrophthalmus japonicus* (De Haan, 1835) 칠게**

Material examined. 6♂♂, 2♀♀, Tabpo, 13 Sep. 1998.

Literature. Kamita, 1941.

Remarks. This is the most dominant species in muddy littoral zone of southern and western coasts in Korea. Kamita (1941) reported this species from Geojedo Island. This species was collected from the mud flat of Tabpo in this survey.

65. *Camptandrium sexdentatum* Stimpson, 1858 여섯니세스랑게

Literature. Kamita, 1941.

Remarks. Kamita (1941) reported this species from Geojedo Island. Thereafter, this species has not been found from this area until now. This is a rare species living in the littoral mud flat of southern and western coasts of Korea.

****66. *Deiratonotus cristatus* (De Man, 1895) 무당게**

Material examined. 1♀, Tabpo, 13 Sep. 1998.

Family Grapsidae MacLeay, 1838 바위게 과

67. *Pachygrapsus crassipes* Randall, 1840 바위게

Literature. Kim *et al.*, 1979 (1♀, Yeonhwado; 4♂♂, Gugdo; 1♂, 5♀♀, Galdo).

Remarks. Kim *et al.* (1979) reported this species from the three islets located near Geojedo. In this survey this species was not found.

68. *Acmeopleura parvula* Stimpson, 1858 애기비단게

Literature. Kamita, 1941.

Remarks. Kamita (1941) reported this species from Geojedo Island. Thereafter, this species has not been found from this island until now.

69. *Eriocheir haponicus* (De Haan, 1835) 동남참게

Literature. Kamita, 1941.

Remarks. Kamita (1941) reported this species from Geojedo Island. Thereafter, this species has not been found from this area until now.

***70. *Gaetice depressus* (De Haan, 1833) 납작게**

Material examined. 7♂♂, 4♀♀, Oepo, 7 Jul. 1996; 2♂♂, 2♀♀, Ssanggeun, 8 Jul. 1996; 2♀♀, Daepo, 9 Jul. 1996; 1♂, 1♀, Yeocha, 9 Jul. 1996.

Literature. Kamita, 1941; Kim *et al.*, 1979 (1♂, 1♀, Bijindo; 3♂♂, 3♀♀, Galdo).

***71. *Hemigrapsus penicillatus* (De Haan, 1835) 풀게**

Material examined. 1♂, 3♀♀, Oepo, 7 Jul. 1996; 2♂♂, 1♀, Ssanggeun, 8 Jul. 1996; 1♀, Daepo, 9 Jul. 1996; 3♂♂, Yeocha, 9 Jul. 1996; 2♂♂, 1♀, Susan, 29 Jan. 1997.

Literatures. Kamita, 1941; Kim *et al.*, 1979 (1♂, 1♀, Bijindo; 3♂♂, 3♀♀, Galdo).

***72. *Hemigrapsus sanguineus* (De Haan, 1835) 무늬발게**

Material examined. 2♂♂, 1♀, Oepo, 7 Jul. 1996; 2♂♂, 2♀♀, Ssanggeun, 8 Jul. 1996; 3♂♂, 2♀♀, Yeocha, 9 Jul. 1996; 6♂♂, 3♀♀, Susan, 29 Jan. 1997; 2♂♂, 5♀♀, Heungnam, 30 Jan. 1996; 2♀♀, Susan, 29 Jan. 1997.

Literature. Kamita, 1941.

73. *Hemigrapsus longitarsis* (Miers, 1879) 긴종아리풀게

Literature. Kamita, 1941.

Remarks. This species was reported as a new species from Korea by Miers (1879). Since then Kim (1973) cited Kamita's short description. Thereafter this species has been listed without description (Kim and Kwon, 1983; Kim, 1985) from other areas of the South Sea of Korea (the Korea Strait). Recently Kim and Kim (1995) redescribed this species based upon the material of Chindo Island. This species was reported by Kamita (1941) from the Geoje Island. Thereafter, this species has not been found from this island until now.

****74. *Helice tridens tridens* De Haan, 1835 방게**

Material examined. 7♂♂, 3♀♀, Tabpo, 13 Sep. 1998.

***75. *Helice tridens wuana* Rathbun, 1929 수동방게**

Material examined. 5♂♂, 6♀♀, Tabpo, 13 Sep. 1998.

Literature. Kamita, 1941.

Remarks. This species lives in the muddy littoral zone of southern and western coasts of Korea. Kamita (1941) reported this species from Geoje area. This species was collected from the mud flat of Tabpo in this survey.

****76. *Sesarma dehaani* H. Milne Edwards, 1853 말뚝게**

Material examined. 2♂♂, 4♀♀, Tabpo, 13 Sep. 1998.

****77. *Sesarma erythrodactyla* Hess, 1865 붉은발사각게**

Material examined. 2♂♂, 4♀♀, Tabpo, 13 Sep. 1998.

Remarks. This species is common in muddy upper littoral zone of southern and western coasts in Korea and first reported by Kim and Kim (1982) without any detailed description and illustration. Recently Kim and Kim (1995) redescribed this species based upon the material of Chindo Island. In this survey this species was collected from the upper littoral zone of mud flat.

***78. *Sesarma haematocheir* (De Haan, 1833) 도둑게**

Material examined. 1♂, 1♀, Tabpo, 13 Sep. 1998.

Literature. Kamita, 1941; Kim *et al.*, 1979 (1♂, Bijindo).

Remarks. This species lives in brackish area of muddy littoral zone of southern and western coasts in Korea. Kamita (1941) reported this species from Geoje Island. In this survey, this species was collected from the brackish water of Tabpo in this island.

****79. *Sesarma pictum* (De Haan, 1835) 사각게**

Material examined. 9♂♂, 11♀♀, Tabpo, 13 Sep. 1998.

***80. *Plagusia dentipes* De Haan, 1833 톱장절게**

Material examined. 1♂, Ssanggeun, 8 Jul. 1996; 2♀♀, Daepo, 9 Jul. 1996; 2♂♂, 1♀, Daepo, 14 Sep. 1998.

Family Majidae Samouelle, 1819 물맞이게 과

***81. *Achaeus japonicus* (De Haan, 1839) 아케우스게**

Material examined. 13♂♂, 7♀♀, Daepo, 9 Jul. 1996; 8♂♂, 11♀♀, Daepo, 14 Sep. 1998.

Literature. Kim *et al.*, 1979 (1♂, Haegumgang).

***82. *Pyromaia tuberculata* (Lockington, 1877) 한뿔두드럭게**

Material examined. 3♂♂, Oepo, 7 Jul. 1996; 1♀, Heungnam, 30 Jan. 1998.

Remarks. This southern form is distributed in Japan and America (California to Panama Bay). In Korea, one female and one male of this species were reported by Kim (1985) from Chugbyeon, Kangwondo. It may suggest that a part of Kangwondo is influenced by warm current. This species was collected from the offshore of Geojedo Island in this survey. The occurrence of this species in this area is quite reasonable, because this area is strongly washed by the Tsushima warm current.

****83. *Pugettia incisa* (De Haan, 1837) 오늬이마물맞이게**

Material examined. 1♂, Yeocha, 9 Jul. 1996.

Remarks. This species is distributed in Korea, Japan, and East China. In Korea it is found from the East Sea (the Japan Sea), the South Sea (the Korea Strait), and the Chejudo waters. This is sometimes confused with *P. quadridens quadridens* but is peculiar in that the postocular tooth and hepatic lobe are completely fused together and cardiac and epibranchial processes are conical and acuminate.

****84. *Pugettia minor* Ortmann, 1894 꼬마물맞이게**

Material examined. 2♂♂, 1♀, Yeocha, 9 Jul. 1996.

Remarks. Kim and Chang (1985) reported this species from the Chejudo waters. It is characterized by following characteristics: The carapace is naked and bears three spine-tipped tubercles in the median line of carapace, of which the median tubercles is the largest. The epibranchial spine on lateral margin is relatively small and slender. The present report is the second in Korean waters. The specimens were collected mainly among bryozoans and sea weeds by scuba diving.

****85. *Pugettia quadridens intermedia* Sakai, 1938 중간뿔물맞이게 (Fig. 1, 2A-F)**

Pugettia minor Shen, 1937, p. 288, text-figs. 5a, d, f, g.

Pugettia quadridens intermedia Sakai, 1938, p. 258, pl. 36, fig. 2; 1965, p. 72, pl. 32, fig. 3; Kim and Kim, 1986, p. 325.

Material examined. 1♂, Oepo, 7 Jul. 1996; 2♂♂, 1♀, Daepo, 9 Jul. 1996; 2♂♂, 2♀♀, Yeocha, 9 Jul. 1996; 3♂♂, 1♀, Susan, 29 Jan. 1997; 1♂, 2♀♀, Heungnam, 30 Jan. 1997; 4♂♂, 3♀♀, Daepo, 14 Sep. 1998.

Description. Carapace (Fig. 1) nearly as long as wide except for rostrum, each regions well defined by grooves; gastric region mounted with four tubercles; cardiac region conical, mounted with a tubercle; intestinal region also marked with a tubercle. Hepatic spine slender, curved forward at tip, more or less fused with postorbital tooth. Branchial spine on lateral side very prominent, projecting forward at tip; epibranchial surface with two tubercles, also another on inner side of lateral spine.

Chelipeds (Fig. 2A) strong, sexually dimorphic; those of female weak and slender; upper border of merus prismatic with a row of three laminar teeth; palm oblong, its superior border sharply crested.

Walking legs (Fig. 2B, C) slender, gradually decreasing in length; first leg (Fig. 3B) longest, two times longer than that of fourth leg (Fig. 2C). Dactyls of all legs with two row of small tubercles.

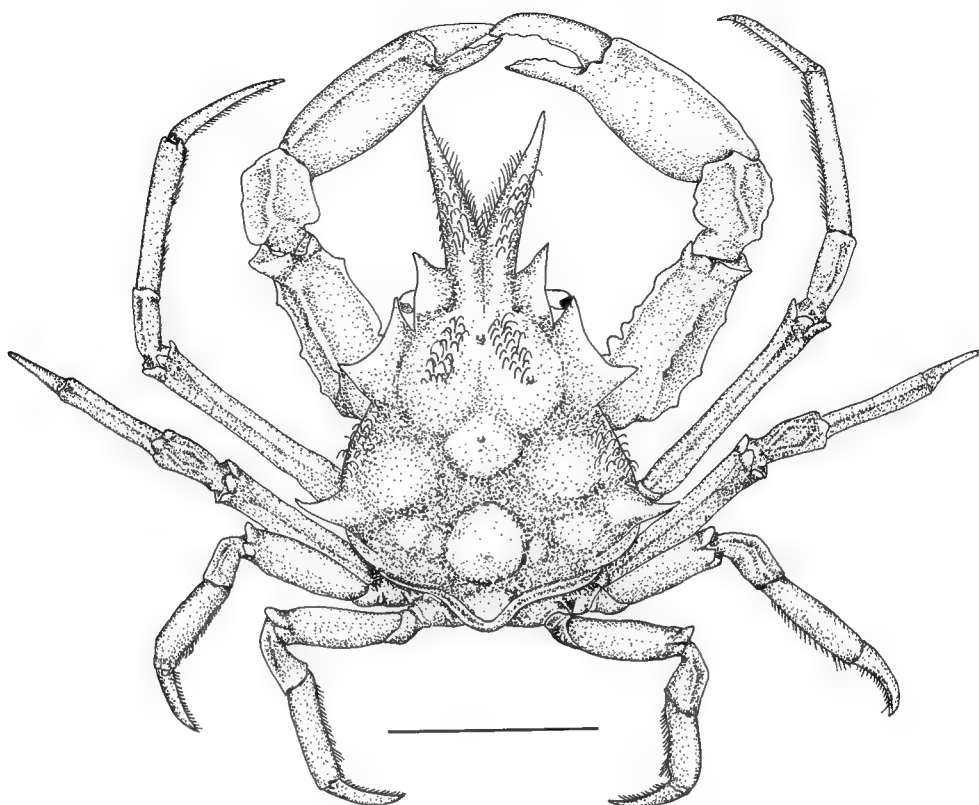


Fig. 1. *Pugettia quadridens intermedia* Sakai, male. habitus, dorsal view. Scale: 10 mm.

Abdomen in male (Fig. 2D) seven-jointed, each segments except for first one almost same in length.

Male gonopod (Fig. 2E, F) slender, gradually narrowing distally, its distal end trilobated.

Remarks. *P. quadridens intermedia* was reported as new to Korea by Kim and Kim (1986) without any detailed description and illustrations. Therefore it seems appropriate to redescribe this species herein with illustrations. In the key to the Japanese species of the genus *Pugettia* Dana, 1851, Sakai (1976) considered the following features as the main key characteristics of this species. First, this species is similar to *P. quadridens quadridens* but the postorbital tooth is more or less fused with the hepatic lobe, although its fusion is not perfect. Secondly, the carapace and thoracic legs are mottled with whitish color. Although we could not obtain the original description, we did confirm the important characteristics of the Sakai (1976)'s description to this species and key to genus *Pugettia*. The present specimens were collected mainly among sea weeds of rocky offshore. Additionally, Ko and Hwang (1997) reported the larval development of this species. In that paper they discussed the systematic status of *P. quadridens intermedia*.

Distribution. Korea (Korea Strait), Japan (Sakami Bay, Izu Peninsula, Mikawa Bay, Shima Peninsula, Kii Peninsula).

***86. *Pugettia quadridens quadridens* (De Haan, 1837) 뽕물맛이게**

Material examined. 1♀, Oepo, 7 Jul. 1996; 2♂♂, 1♀, Daepo, 9 Jul. 1996; 1♀, Susan, 29 Jan. 1997; 1♂, 3♀♀, Daepo, 14 Sep. 1998.

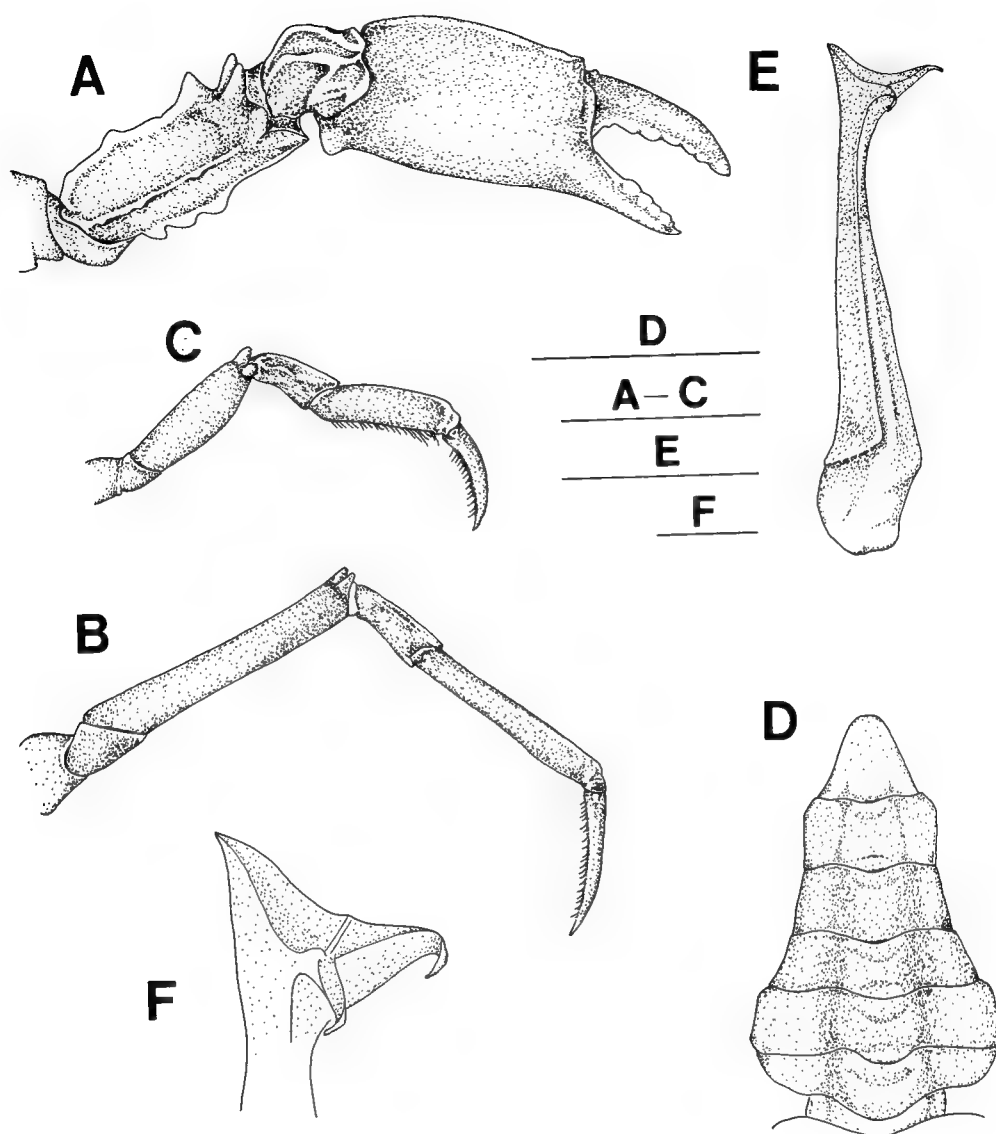


Fig. 2. *Pugettia quadridens intermedia* Sakai, male. A, right cheliped, outer view; B, right first walking leg; C, right fourth walking leg; D, abdomen; E, right gonopod, outer view; F, tip of right gonopod. Scale: A-C = 10 mm; D = 5 mm; E = 2 mm; F = 0.5 mm.

Literature. Kim *et al.*, 1979 (1 ♀, Bijindo; 7 ♂ ♂, Yeonhwado, 1 ♂, 1 ♀, Hongdo; 4 ♂ ♂, 1 ♀, Galdo; 1 ♂, Haegeumgang).

Remarks. This species is most common within the genus *Pugettia* in Korean waters and is characterized by the following characteristics (Kim, 1973; Sakai, 1976; Dai and Yang, 1991). Firstly, the body and appendages are usually naked. Secondly, the postocular tooth and hepatic lobe not fused, and the hepatic lobe not larger than the postocular or epibranchial tooth. Thirdly, the cardiac region is not protuberant. Fourthly, the rostral spines are about one-fifth the length of carapace and their outer borders subparallel. They live mainly in the weedy and muddy-sandy bottoms at low-tide.

***87. *Hyastenus elongatus* Ortmann, 1894** 박뿔게

Material examined. 1♂, Oepo, 7 Jul. 1996; 4♂♂, 6♀, Daepo, 9 Jul. 1996; 7♂♂, 3♀♀, Daepo, 14 Sep. 1998.

Literature. Kim *et al.*, 1979 (1♂, Haegeumgang).

****88. *Scyra compressipes* Stimpson, 1857** 납작뿔게

Material examined. 2♂♂, 5♀♀, Daepo, 9 Jul. 1996; 5♂♂, 4♀♀, Daepo, 14 Sep. 1998.

****89. *Chlorinoides longispinus* (De Haan, 1839)** 뽕뿔가시뿔게

Material examined. 1♂, Oepo, 7 Jul. 1996

Family Hymenosomatidae MacLeay, 1838 말강게 과

90. *Rhynchoplax messor* Stimpson, 1858 주걱말랑게

Literature. Kim *et al.*, 1979 (3♂♂, 1♀, Galdo).

****91. *Rhynchoplax setirostris* Stimpson, 1858** 가는다리말랑게

Material examined. 1♂, Yeocha, 9 Jul. 1996.

Family Parthenopidae MacLeay, 1838 자게 과

****92. *Parthenope valida* De Haan, 1839** 자게

Material examined. 1♂, 1♀, Daepo, 9 Jul. 1996; 1♂, Daepo, Sep. 14, 1998.

93. *Harrovia elegans* De Man, 1887 갯고사리게

Literature. Kim *et al.*, 1979 (1♂, Yeonhwado).

DISCUSSION

As a result of this investigation chiefly conducted during the period from July, 1996 to September, 1998, 79 species of decapods in 28 families were identified from 7 localities in Geojedo Island, Korea. Of these, 9 species of shrimps, 7 species of anomurans, and 39 species of crabs are newly reported from Geojedo area. Therefore, with the previous records, a total of 93 decapod species (12 species of shrimps, 17 of anomurans, and 64 of crabs) are known to occur in Geojedo Island and its adjacent islets.

Kim *et al.* (1979) reported one female shrimp of the genus *Betaeus* without specific name which had never been known in Korean waters. In this survey three individuals of same species were also collected from Heungnam of Geojedo Island. But unfortunately, we did not find their first pereopods (chelipeds) which are most important in keying out the *Betaeus* species. The specific status of these specimens is waiting for the further study. The taxonomic status of *P. quadridens* subspecies in Korea has not been well established until Kim and Kim (1986) reported *P. quadridens intermedia*, which had been confused with *P. quadridens quadridens*. However the confusion has been still remained in these subspecies, because there are no descriptions and illustrations in their report. For this reason, the authors redescribed *P. quadridens intermedia* with illustrations based on the materials collected from the Geojedo area. Although we could not refer to the original description, we confirmed the important characteristics of the Sakai (1976)'s description and key. Our specimens of *P. quadridens intermedia* agree well with the Sakai's description and key to the genus *Pugettia*.

Table 1. Number of species and subspecies of Macrura, Anomura, and Brachyura categorized by distribution forms.

Distribution forms	N	T	S	C	No. species
Macrura	—	8 (66.7%)	4 (33.3%)		12
Anomura	1 (5.9%)	12 (70.6%)	3 (17.6%)	1 (5.9%)	17
Brachiura	—	30 (46.2%)	35 (53.8%)		64

Abbreviations: N = Northern form; T = Temperate zone form; S = Southern form; C = Cosmopolitan species.

Table 2. The geographical distribution forms of branchiuran decapods from six areas.

Regionss	N	T	S	No. species
Chejudo	2 (1.8%)	40 (38.5%)	62 (61.5%)	104
Chindo I.	—	27 (58.7%)	19 (41.3%)	46
Wando I./Pogildo I.	—	18 (62.1%)	11 (37.9%)	29
Geomundo I.	—	12 (54.4%)	10 (45.5%)	22
Geojedo I.	—	29 (45.3%)	35 (54.7%)	64
Ullungdo I.	2 (6.1%)	18 (54.5%)	13 (39.4%)	33

References: Present paper for Geojedo I.; Kim and Kim (1985) for Geomundo I.; Kim and Chang (1985) for Chejudo; Kim and Kim (1995) for Ullungdo I.; Kim and Kim (1995) for Chindo I.; Kim and Kim (1996) for Wando I. and Pogildo I.

Table 1 shows the species composition of the 93 decapods from Geojedo Island according to the distribution forms. Of these, 64 species of branchiuran crabs consist of 30 species (46.2%) of temperate zone forms and 35 species (53.8%) of southern forms. Of 64 brachyuran crabs, 52 species (81.3%) are shared with Chejudo. Among 17 species of anomurans, 12 species (70%) are temperate zone forms, and 3 species (17.6%) are southern forms, and one is a species widely distributed in Korea, Japan, and Russia. Of 12 species of macruran shrimps, 8 (66.7%) are temperate zone forms and 4 (33.3%) are southern forms. The dominance of southern forms (53.8%) of crabs are quite considerable, because temperate zone form is more dominant (53.3%) in the South Sea of Korea (Kim and Kim, 1982). Compared with the previous data (Kim *et al.*, 1979), the southern form is decreased. The reason of this seems to be the increase of temperate species collected from intertidal zone. The brachyuran decapods of Geojedo Island showed the high species diversity next to the Chejudo waters and occupied the 53.3% of the 120 brachiuran species occurring to the whole region of the South Sea. Table 2 shows the distribution forms of the brachyuran decapods from six areas. The number of southern forms is the largest in Chejudo waters (61.5%) and followed by that of Geojedo Island (54.7%). On the other hand, temperate zone forms are more abundant than the southern forms in other regions. When looking at the similarity coefficients (Table 3) between Chejudo waters and Geojedo Island, it is relatively high (0.41). This fact support that the southern forms in Geojedo Island is dominant. While, the coefficient between the East Sea and the Geojedo Island is also high (0.45). The reason seems that over 85 % of the crabs are the common species which simultaneously occur to the East Sea and the South Sea where Geojedo Island lies.

Table 3. Number of species or subspecies common to both regions of every pair of five regions and similarity coefficient* (r).

Regions	No. sp.	East Sea	Korea Strait	Chejudo I.	Yellow Sea	Geojedo I.
East Sea	62		53	41	30	39
Korea Strait	121	0.41 (53/130)		67	72	60
Chejudo	104	0.33 (41/125)	0.42 (67/158)		29	52
Yellow Sea	74	0.28 (30/106)	0.59 (72/123)	0.19 (29/149)		36
Geojedo	64	0.45 (39/87)	0.48 (60/125)	0.41 (52/126)	0.35 (36/102)	

Reference: The present paper for Geojedo; Kim (1986) for all of other four regions. *Jaccard's coefficient: $r = a/a + b + c$. a: the number of species common to both regions. b and c: the number of species occurring in only one of the two regions.

Additionally, *Dromidia unidentata* and *Pugettia minor* found from only Chejudo are known to live also in Geojedo through this investigation. Therefore the distributional range of these species are extended to the eastern part of the South Sea. *Pyromaia tuberculata* considered as southern form is distributed in Japan and America (California to Panama Bay). In Korea, one female and one male of this species were reported from Chukbyeon, Kangwondo, East Sea. The occurrence of these species, *P. minor*, *D. unidentata*, and *P. tuberculata*, in Geojedo area is quite understandable, because this area is situated under the influence of the Tsushima warm current. Consequently, from the viewpoint of geographical distribution, similarity coefficient, and species occurrence, the Geojedo area except for Chejudo waters is most strongly influenced by the Tsushima warm current, a branch of the Kuroshio warm current compared with other areas of the South Sea.

ACKNOWLEDGEMENTS

This paper is dedicated to Professor Boon Jo Rho on the occasion of retirement. This study was partially supported by grants from KOSEF in 1995-1998 (95-0401-04-01-3) and SRC (97K3-0401-03).

REFERENCES

- Bowman, T.E., and L.G. Abele, 1982. Classification of recent Crustacea, In: The Biology of Crustacea, Vol. 1, Systematic, the Fossil Record, and Biogeography, (ed., L.G. Abele). Academic Press, New York, pp. 1-27.
- Dai, A., and S. Yang, 1991. Crabs of the China Seas. China Ocean Press, Beijing, pp. 128-131.
- Kamita, T., 1941. Studies on the decapod crustaceans of Chosen. Part I. Crabs. Fisher. Soc. Chosen, pp. 1-289 (cited from Kim, 1973).
- Kim, H.S., 1970. A checklist of the Anomura and Brachyura (Crustacea, Decapoda) of Korea. Seoul National Univ. J. Bio. Agr. Ser. (B), **21**: 1-34.
- Kim, H.S., 1973. Illustrated encyclopedia of fauna & flora of Korea. vol. 14, Anomura & Brachyura. Samhwa

Publishing Co. Ltd., Seoul, Korea, 694 pp., pls. 1-112.

- Kim, H.S., 1985. Systemtic studies on crustaceans of Korea, 1. Decapods. *Proc. Coll. Natur. Sci., SNU*, **10**(1): 63-94.
- Kim, H.S., 1986. On the geographical distribution of anomuran and brachyuran crabs in Korean waters. *Korean J. Syst. Zool.*, **2**(2): 67-78.
- Kim, H.S., and C.Y. Chang, 1985. The brachyuran crabs of Cheju Island, Korea (Crustacea: Decapoda). *Korean J. Syst. Zool.*, **1**(1-2): 41-60.
- Kim, H.S., and I.H. Kim, 1985. Marine invertebrate fauna of Komundo I., Taesambudo I. and Sangpaekdo I. *Rep. Surv. Nat. Environ. Koera*, **4**: 181-206.
- Kim, H.S., and I.H. Kim, 1986. Marine invertebrate fauna of Chujado Islands. *Rep. Surv. Nat. Environ. Koera*, **5**: 309-332.
- Kim, H.S., and D.H. Kwon, 1983. Marine invertebrate fauna in the vicinity of Jindo Island. *Rep. Surv. Nat. Environ. Koera*, **3**: 313-336.
- Kim, H.S., and B.J. Rho, 1971. On the distribution of the benthic animals of Korean coastal Seas, 1. Jeju Island region. Report for the IBP, Korean National Committee for IBP, **5**: 7-27.
- Kim, H.S., B.J. Rho, S.Y. Hong, I.H. Kim, S. Shin, and C.H. Han, 1979. The marine invertebrate fauna in the southern part of Geoje Island and it's adjacent five islands. The Report of KACN, no. 14: 103-126.
- Kim, W., and H.S. Kim, 1982. Classification and geographical distribution of Korean crads (Crustacea, Decapoda, Brachyura). *Proc. Coll. Natur. Sci., SNU*, **7**(1): 133-159.
- Kim, W., and S.H. Kim, 1995. The brachyuran crabs (Crustacea: Decapoda) of Chindo Island Korea. *Korean J. Syst. Zool.*, **11**(4): 497-508.
- Kim, W., S.H. Kim, and S.J. Song, 1995. Marine decapods of Ulrung and Tokdo Islands. *Rep. Surv. Nat. Environ. Koera*, **10**: 413-437.
- Kim, W., S.H. Kim, T.K. Seo, and H.S. Rho, 1996. Marine decapods of Pogil Island and its adjacent island. *Pep. Surv. Nat. Environ. Koera*, **11**: 363-390.
- Kim, W., and S.Y. Moon, 1994. The shrimp (Crustacea: Decapoda) of Ulreung Island, Korea. *Korean J. Zool.*, **37**: 262-266.
- Ko, H.S., and S.K. Hwang, 1997. Meglupal stages of three *Pugettia* species (Crustacea: Decapoda: Majidae) reared in the laboratory. *Korean J. Syst. Zool.*, **13**(4): 261-270.
- Miers, J.E., 1879. On Crustacea from Korean and Japanese Seas. *Zool. Soc. London*, pp. 18-60.
- Sakai, T., 1938. Study on the crabs of Japan. III. Brachygnatha, Oxyrhyncha. Yokendo, Tokyo, pp. 193-364 (cited from Sakai, 1976).
- Sakai, T., 1976. Crabs of Japan and the adjacent seas. Kodansha Ltd., pp. 193-201.
- Shen, C.J., 1937. On some account of the crabs of North China. *Bull. Fan Memorial Inst. Biol. Peiping*, vol. 7, pp. 167-185 (cited from Sakai, 1976).

RECEIVED: 1 September 1998

ACCEPTED: 19 September 1998

거제도의 해산 십각류

김 사 홍 · 김 원
(서울대학교 분자생물학과)

요 약

거제도의 십각류상을 밝히기 위한 분류학적 연구를 수행하였다. 그 결과 28과 79종이 동정되었으며, 이 가운데 새우류 9종, 집게류 7종, 게류 39종이 거제도의 십각류상에 추가되었다. 과거기록을 포함하여 총 93종의 분류목록을 마련하였으며, 기재없이 기록만 있었던 중간빨물맞이게 (*Pugettia quadridens intermedia* Sakai, 1938)를 재기재 하였다. 또한 게류 64종의 분포형과 종의 출현양상을 근거로 거제도의 동물지리적 양상을 논하였다.